Clinical audit: a useful tool for reducing severe postpartum haemorrhages?

Corinne Dupont, Catherine Deneux-Tharaux, Sandrine Touzet, Cyrille Colin, Marie-Hélène Bouvier-Colle, Jacques Lansac, Simone Thevenet, Claire Boberie-Moyrand, Gaëlle Piccin, Marie-Pierre Fernandez, et al.

Clinical audit: a useful tool for reducing severe postpartum haemorrhages?

Running title: Audit of postpartum haemorrhage

Word count for abstract: 238

Word count for text: 3010

Abstract

Objective. Reducing the rate of severe postpartum haemorrhage (PPH) is a major challenge in obstetrics today. One potentially effective tool for improving the quality of care is the clinical audit, that is, peer evaluation and comparison of actual practices against explicit criteria. Our objective was to assess the impact of regular criteria-based audits on the prevalence of severe PPH.

Design. Quasi-experimental before-and-after survey

Setting. Two French maternity units in the Rhône-Alpes region, with different organisation of care.

Participants. All staff of both units.

Intervention. Quarterly clinical audit meetings at which a team of reviewers analysed all cases of severe PPH and provided feedback on quality of care and where all staff actively participated.

Main outcome measures. The primary outcome was the prevalence of severe PPH. Secondary outcomes included the global quality of care for women with severe PPH, including the performance rate for each recommended procedure. Differences in these variables between 2005 and 2008 were tested.

Results. The prevalence of severe PPH declined significantly in both units, from 1.52% to 0.96% of deliveries in the level III hospital ($p=0.048$) and from 2.08% to 0.57% in the level II hospital ($p<0.001$). From 2005 to 2008, the proportion of deliveries with severe PPH that were managed consistently with the guidelines increased for all of its main components, in both units.

Conclusion. Regular clinical audits of cases severe PPH were associated with a persistent reduction in the prevalence of severe PPH.

Introduction

Severe postpartum haemorrhage (PPH) is the main component of severe maternal morbidity in developed countries, and reducing its rate is a major challenge in obstetrics today. In France, PPH is the leading cause of maternal mortality, and data from the French Confidential Enquiries into maternal deaths show that 80% of deaths due to PPH might have been prevented by timely and appropriate care (1). The French College of Obstetrics & Gynaecology (CNGOF) issued the first national clinical guidelines on PPH prevention and management in France in November 2004 (2). However, the passive dissemination of guidelines is by itself insufficient to change professionals' practices (3).

Clinical audit is a quality improvement process that seeks to improve patient care and outcomes by looking at current actual practices through the review of cases according to explicit criteria and uses the findings to modify the organisation and the content of care if necessary (4, 5). Few studies have assessed the impact of clinical audits in obstetrics (6,7,8), and none, to our knowledge, has focused specifically on PPH. Information on the feasibility of clinical audits of deliveries with severe PPH and the results that can be expected from this tool would be useful to clinicians (9).

The Pithagore6 trial was a cluster-randomised trial, with the maternity unit as the unit of randomisation, to evaluate a multifaceted educational intervention for reducing the rate of severe PPH. It included 106 French maternity units and finally found no significant difference in the severe PPH rate between the hospitals with the intervention and the control hospitals (10). The intervention included a clinical audit of deliveries with severe PPH in all maternity units in the intervention arm. Two of these hospitals decided to continue the clinical audit meetings on a regular basis. The objective of this report is to describe the change in the prevalence of severe PPH and in the quality of care provided in these cases after the implementation of routine audits in two hospitals with different levels and organisation of care.

Methods

A before-and-after survey was designed to assess the impact of the routine use of clinical audits.

Population

The study was conducted in France in two maternity hospitals located in the Rhône-Alpes region. Both were part of the Pithagore6 research program (10) and decided, after the study's conclusion, to integrate the clinical audit into their routine practice. Croix-Rousse Hospital is a level III university hospital, that is, a reference centre with an onsite neonatal intensive care unit and around 3000 deliveries a year. Valence Hospital is a level II hospital that has a neonatal unit and around 2000 annual deliveries. Both units have an anaesthetist and a junior and a senior obstetrician on site at all times, as well as an onsite blood bank, arterial embolisation facilities and an adult intensive care unit. They also have written protocols, consistent with national guidelines, for the management of obstetric haemorrhages.

From 2005 through 2008**,** the obstetrics departments of both hospitals held clinical audit meetings every three months to analyse all cases of severe PPH in the preceding quarter. Severe PPH was defined as a PPH associated with one or more of the following: blood transfusion, arterial embolisation, arterial ligation, other conservative uterine surgery, hysterectomy, transfer to an intensive care unit, peripartum haemoglobin drop of 4 g/dl or more, or maternal death. Women with transfusions during the postpartum period but not clinically diagnosed with PPH were not included. Deliveries with severe PPH were prospectively identified and reported at the daily obstetric staff meeting, and one midwife in each hospital was responsible for collecting cases and checking that all pertinent information was included in the file.

Clinical audit

In each unit, all cases of severe PPH that occurred during the previous 3 months were reviewed during a quarterly meeting of the local clinicians. All members of maternity unit's medical staff (obstetricians, midwives and anaesthetists) were asked to participate. Participation in this meeting was considered working time. From 20 to 25 people attended each meeting. In each unit, a three-member audit team

— an obstetrician, a midwife and an anaesthetist — conducted the clinical audit. A member of the team caring for the woman at the time the PPH occurred presented each case. The content of the obstetric files was also available to the audit team.

The clinical audit included three steps. First, the appropriateness of the care provided was critically analysed by the audit team in a discussion with the other clinicians. Management was assessed according to explicit criteria derived from the main components of the national guidelines: examination of the uterine cavity and/or manual removal of the placenta within 15 minutes of the PPH diagnosis; instrumental examination of the vagina and cervix; intravenous administration of oxytocin; and if PPH persisted and was due to uterine atony, intravenous administration of sulprostone (second line oxytocic) within 30 minutes of the initial diagnosis. A standardised audit form (available on request to the authors) was completed for each case and stated whether each recommended procedure was performed.

At the end of this analysis, the audit team offered an oral synthesis of the practices, feedback about what was done wrong and what was done well, and a consensus was then made by the audit meeting on the global quality of care provided (optimal, suboptimal, non-optimal). Care was considered optimal if the following four major components of recommended care were performed within the required time: examination of the uterine cavity/manual removal of placenta; call for additional staff; administration of oxytocin; and administration of sulprostone if uterine atony persisted. If at least one of these major components was absent, care was considered non-optimal. Care was considered suboptimal if all major procedures were performed but at least one was not done within the recommended time or another minor component of care did not comply with the recommendations.

The second step of the audit consisted in an active discussion involving all meeting participants and facilitated by the audit team to identify the specific reasons for sub- or non-optimal care, both in terms of content and organization. Finally, the group analysed the reasons identified in the second step and defined practical ways to improve the specific non-optimal aspects, in view of local constraints and the specific context. One person, usually a senior midwife, was in charge of monitoring implementation of the recommended actions. After the meeting, the senior midwife reduced these conclusions to writing

and sent them by email to each participant. They were also made available to all staff of the maternity unit in the labour ward.

Study variables

The data routinely collected by the units includes characteristics of pregnancy and delivery known to be risk factors for severe PPH: previous caesarean delivery, multiple pregnancy, placenta praevia or accreta, mode of delivery, and foetal macrosomia (baby's weight > 4000 g), as well as any postpartum haemorrhage (clinically assessed by the caregivers). These data were extracted for this study, together with their proportions among annual deliveries (from each unit's annual report).

The primary outcome was the prevalence of severe PPH, calculated as the number of cases divided by the total number of deliveries. Secondary outcomes included the rates of the principal recommended interventions for PPH management, extracted from the data collected during the audits. Specifically, we calculated the rate of calls for additional staff and administration of oxytocin for all cases. The rates of examination of the uterine cavity within 15 minutes of diagnosis and of instrumental examination of the vagina and cervix were assessed for severe PPH following vaginal delivery. Lastly, the rate of administration of sulprostone within 30 minutes of the diagnosis was assessed for the cases due to uterine atony.

Analysis

Differences between the before (2005) and after (2008) periods for primary and secondary outcomes were tested with the chi-square test or Fisher's exact test, as appropriate, as were differences in the prevalence of individual risk factors for severe PPH between these periods.

Results

The characteristics of parturient women did not change significantly from 2005 to 2008 in the level II unit, although in the level III unit, the rate of instrumental vaginal deliveries increased significantly, from 7.3% in 2005 to 10.5% in 2008, as did the rate of deliveries with PPH, from 4.0% of deliveries in 2005 to 6.1% in 2008 (Table 1). This global increase in the PPH annual rate resulted from the

combination of a decrease in PPH after spontaneous and instrumental vaginal deliveries (from 2.0% to 1.85% and from 7.9% to 3.5%, respectively) and a concomitant significant increase in the PPH rate after caesarean deliveries, from 9.6% in 2005 to 20.4% in 2008.

A significant reduction in the prevalence of severe PPH occurred in both hospitals between 2005 and 2008, from 2.1% to 0.6% in the level II hospital and from 1.5% to 1.0% in the level III hospital (Table 2). In the level II unit, the prevalence of severe PPH decreased for both vaginal and caesarean deliveries. In the level III unit, on the other hand, the prevalence of severe PPH after vaginal deliveries fell significantly, but the prevalence after caesareans did not change.

The global quality of care provided to women with severe PPH improved in both units between 2005 and 2008, although the difference reached statistical significance only in the level III hospital (Table 3). The proportion of cases for which management was considered optimal increased from 47% to 73% in the level II unit and from 22% to 61% in the level III unit.

In both units in 2005, the main deviations from recommended care once PPH was diagnosed were no or delayed examination of the uterine cavity (57% in the level II and 74% in the level III unit), the absence of instrumental examinations of vagina and cervix (76% and 59% of severe PPH cases, respectively), and no or delayed administration of second-line uterotonics when uterine atony persisted (71% and 86%).

From 2005 to 2008, the proportion of deliveries with severe PPH that were managed consistently with the guidelines increased for all of the principal components, in both units. In particular, this improvement was statistically significant in both units for the components of care that were the most inappropriate in 2005.

Discussion

This study shows that routine clinical audits can easily be implemented in obstetrics settings and that their regular performance is associated with an improvement in PPH-related practices and with a significant reduction in the prevalence of severe PPH.

Several limitations must be noted. First although the initial audit meeting was part of a research programme, the routine use of the audit that followed was a local initiative in both units, and the external validity of the results may thus be questionable. Our findings nonetheless suggest that clinical audits are a simple and potentially effective tool for units willing to assess and improve the care they provide.

The quality of care for PPH and the specific components of that care were analysed only in cases of severe PPH. A complete assessment of the audit impact would theoretically have required us to analyse practices in all cases of PPH, or in a representative sample of them, and not only in the most severe cases. These data, however, were not available. It is possible that the improvement in practices was actually greater than that observed in cases of severe PPH, since, by definition, the severe cases have worsened and are thus more likely to have received inappropriate care.

The inherent limitations of our observational design prevent this study from proving that the regular audits caused the reduction in the prevalence of severe PPH, and other factors external to the audit may have contributed to this decrease. Obstetrics professionals in France have been focusing on the issue of PPH since the late 1990s, and global improvement in PPH-related practices might have been underway as part of this national context and could explain the decrease in the prevalence of severe PPH found in the 2 units of our study. We consider this hypothesis seems unlikely, however. Firstly, passive dissemination of recommendations for clinical practice has repeatedly been shown to be insufficient to improve practices (11). Secondly, the dramatic reduction found here – with the prevalence of severe PPH after vaginal delivery divided by three -- seems unlikely to have happened in the absence of active intervention. Finally, a regional study in all maternity units of another French region showed no significant decrease in the rate of severe PPH during this time period (12).

Another possible explanation of our results is that the proportion of women at risk for PPH decreased over time. However, neither the prevalence of PPH risk factors among parturient women nor the annual rate of all PPH decreased over this period. Indeed, an inverse trend was observed in the level III unit, where the rates of two important risk factors increased between 2005 and 2008: the number of instrumental deliveries and of women with previous caesareans. These changes may have contributed to the increase in the PPH rate. Under these circumstances, the reduction we observed in the

prevalence of severe PPH suggests a decline in the proportion of the PPH that worsened and became severe, probably due to better management of early PPH. The specific PPH-related practices used as criteria for determining quality of care improved concomitantly. Finally, the implementation of routine audits was associated with a significant reduction in severe PPH in two different maternity units providing different levels of care in different settings. All these elements suggest that the organisation of regular clinical audits is likely to have had a positive effect on the prevalence of severe PPH.

Although there are reports of interventions aimed at improving the global quality of care delivered to mothers and children, or targeting other specific issues in obstetrics, previous studies of interventions to decrease the rate of severe PPH are scarce (13-14). Because those few tested the impact of complex or multifaceted interventions, they are not easily reproducible, and it is difficult to attribute the global effect to one component or another. Only one reported a significant reduction in the rate of severe PPH, obtained over a 3 year period in one centre (13). The present study provides a description of the routine use of one specific tool, the clinical audit, and our findings suggest it has a significant impact on the prevention of severe PPH through effective management of early bleeding. The precise description of the agenda of the audit meetings should make them easily reproducible in other units. In addition, the continuous monitoring of the prevalence of severe PPH and of the proportion of adequate care provides evidence that the audit's impact is sustained over time.

A major strength of regular clinical audits is that they bring practitioners together frequently to discuss the management of severe cases and to define relevant improvement objectives appropriate to the local context and based on the audit's findings (15). Severe PPH is a very pertinent event for clinical audits, because of the availability of management guidelines and its obviously multidisciplinary nature, involving midwives, obstetricians, and anaesthetists. Such multidisciplinary meetings with a facilitator team applying strategies to encourage collaboration, both at the meeting and during care, are likely to increase the audit activity and to improve care.

In our experience, the results that can be expected from a clinical audit meeting depend on several aspects of the audit process: institutional support, by treating participation in the meetings as actual

working time; respect for the facilitator team and their leadership skills; consideration for every participant‘s words; objective assessment of care provided with the help of a standardised form; analysis of the mechanisms that led to the severe event, focused not on individual mistakes, but on understanding individual and collective decision-making processes; and conclusions expressed in terms of improvement strategies. In addition, long-term repetition of the audit appears necessary for it to improve practices and health outcomes. In the level III unit, clear improvement appeared only during the third year of audits. This finding is consistent with the previous report from Rizvi et al of an intervention to decrease the rate of severe PPH (13). This is also likely to explain why no significant improvement was obtained in the Pithagore6 trial where only one audit meeting took place (10): a single meeting is probably insufficient for identifying suboptimal care and its reasons and is certainly insufficient for verifying its improvement.

An interesting finding is the differential changes in the prevalence of severe PPH for vaginal and caesarean deliveries. Caesarean delivery is a recognized risk factor for severe PPH, and the baseline rates of severe PPH in 2005 were higher for caesarean than vaginal deliveries in both units. During the subsequent years and following the implementation of routine audits, the prevalence of severe PPH after vaginal delivery fell quite appreciably in both units. However, severe PPH at caesarean deliveries decreased only in the level II unit; it remained stable in the level III unit and these cases accounted for most of the severe PPH in 2008. The clinical guidelines for PPH management offer more detailed measures for dealing with bleeding after vaginal delivery; it is thus unsurprising that the audits might have had a greater impact on this type of PPH. The concomitant increase in the rate of all PPH after caesarean delivery found in the level III unit may indicate that the procedure itself was associated with a higher risk of bleeding in 2008 than in 2005. Although the mechanisms and management of PPH at caesarean deliveries include surgical issues that may be more difficult to standardise, the current continuous rise in caesarean rates indicates that guidelines focusing on the management of bleeding at caesarean delivery are needed.

The prevalence of severe PPH and the high proportion of inadequate management found at baseline in the two units of this study suggest that room for improvement exists. Because passive dissemination of guidelines does not change practices, specific interventions are required. One feasible tool is the regular clinical audit of severe PPH, and in this study, it was associated with a persistent reduction in the prevalence of severe PPH.

Acknowledgements

The authors thank Mrs Anne Lafon for her help in data monitoring.

Disclosure of interests

The authors have nothing to disclose

Contribution to authorship

CD and CDT participated in the design and the implementation of the study, the collection and the analysis of the data and the drafting and revision of the paper.

ST, CC, MHBC and JL participated in the design of the study and the revision of the paper.

RR initiated the collaborative project, participated in the design and the implementation of the study, the management of the audit meetings, the analysis of the data and the drafting and revision of the paper.

ST, CB, GP, and MPF participated in the organisation of the audit meetings, the collection of the data and the revision of the paper.

Ethics approval

Approval for the Pithgaore6 trial was obtained from the Sud Est III Institutional Review Board and from the French Data Protection Agency (CNIL). No specific ethics approval for this ancillary study was required because outcome data were routinely collected at maternity units and analysed in an aggregate format.

Funding

The work was supported by the French Ministry of Health under its Clinical Research Hospital Program (contract n° 27-35). The Ministry had no role in the design of the trial, the collection, analyses, or interpretation of the data, the writing of the manuscript or the decision to submit it for publication.

References

1. French National Expert Committee on Maternal Mortality (CNEMM), Third Report 2001-2006. *France* 2010:http://www.invs.sante.fr.

2. Goffinet F, Mercier F, Teyssier V, Pierre F, Dreyfus M, Mignon A, et al. [Postpartum haemorrhage: recommendations for clinical practice by the CNGOF (December 2004)]. *Gynecol Obstet Fertil* 2005;33(4):268-74.

3. Dupont C, Touzet S, Colin C, Deneux-Tharaux C, Rabilloud M, Clement HJ, et al. Incidence and management of postpartum haemorrhage following the dissemination of guidelines in a network of 16 maternity units in France. *Int J Obstet Anesth* 2009;18(4):320-7.

4. National Institute for Clinical Excellence. Principles for best practice in clinical audit. Radcliffe Medical Press Ltd, Oxon, UK 2002;available at .

5.Buljac-Samardzic M, Dekker-van Doorn CM, van Wijngaarden JD, van Wijk KP. Interventions to improve team effectiveness: a systematic review. *Health Policy*;94(3):183-95.

6. Pattinson RC, Say L, Makin JD, Bastos MH. Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity. *Cochrane Database Syst Rev* 2005(4):CD002961.

7. Wilson B, Thornton JG, Hewison J, Lilford RJ, Watt I, Braunholtz D, et al. The Leeds University Maternity Audit Project. *Int J Qual Health Care* 2002;14(3):175-81.

8. Chaillet N, Dube E, Dugas M, et al. Evidence-based strategies for implementing guidelines in obstetrics: a systematic review. Obstet Gynecol 2006;108(5):1234-45.

9. Lombarts MJ, Rupp I, Vallejo P, Sunol R, Klazinga NS. Application of quality improvement strategies in 389 European hospitals: results of the MARQuIS project. *Qual Saf Health Care* 2009;18 Suppl 1:i28-37.

10. Deneux-Tharaux C, Dupont C, Colin C, Rabilloud M, Touzet S, Lansac J, et al. Educational multifaceted intervention to decrease the rate of severe postpartum haemorrhage- the Pithagore6 cluster-randomized controlled trial. *BJOG* 2010;DOI:10.1111/j.1471-0528.2010.02648.x.

11. Freemantle N, Harvey EL, Wolf F, Grimshaw JM, Grilli R, Bero LA. Withdrawn: Printed educational materials: effects on professional practice and health care outcomes. Cochrane Database Syst Rev 2007; 2: CD 000172.

12. Audureau E, Deneux-Tharaux C, Lefevre P, Brucato S, Morello R, Dreyfus M, et al. Practices for prevention, diagnosis and management of postpartum haemorrhage: impact of a regional multifaceted intervention. *Bjog* 2009;116(10):1325-33.

13.Rizvi F, Mackey R, Barrett T, McKenna P, Geary M. Successful reduction of massive postpartum haemorrhage by use of guidelines and staff education. *Bjog* 2004;111(5):495-8.

14. Skupski DW, Lowenwirt IP, Weinbaum FI, Brodsky D, Danek M, Eglinton GS. Improving hospital systems for the care of women with major obstetric hemorrhage. *Obstet Gynecol.* 2006;107(5):977-83.

15. Zwarenstein M, Goldman J, Reeves S. Interprofessional collaboration: effects of practice-based interventions on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2009(3):CD000072.

Table 1: Characteristics of pregnancy and delivery in parturient women, 2005 to 2008, in the 2 units

	2005		2006		2007		2008		
Level II Unit	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**P***
All	1 538	*100.0*	1 469	*100.0*	1 552	*100.0*	1 899	*100.0*	
Previous caesarean	134	*9,4*	181	*12,3*	185	*11,6*	201	*10,6*	0.1
Multiple pregnancy	43	*2,9*	22	*1,5*	42	*2,6*	38	*2,0*	0.3
Placenta praevia	17	*1,2*	17	*1,2*	5	*0,3*	12	*0,6*	0.1
Caesarean delivery	386	*26,3*	356	*24,2*	363	*22,7*	461	*24,3*	0.9
Instrumental vaginal delivery	102	*7.2*	117	*8.1*	150	*9.7*	185	*9.7*	0.1
Fetal macrosomia	109	*7.2*	109	*7.3*	110	*6.9*	140	*7.2*	0.9
Postpartum haemorrhage	63	*4.1*	73	*5*	87	*5.6*	65	*4.2*	0.3
Level III Unit	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**P***
All	2 962	*100*	3 113	*100*	3 058	*100*	3 213	*100*	
Previous caesarean	219	*7,5*	342	*11,0*	354	*11.5*	353	*11,0*	<0.01
Multiple pregnancy	97	*3,3*	93	*3,0*	112	*3,7*	99	*3,1*	0.8
Placenta praevia	31	*1,1*	38	*1,2*	33	*1,1*	35	*1,1*	0.6
Caesarean delivery	636	*21,8*	691	*22,2*	682	*22,3*	706	*22,0*	0.8
Instrumental vaginal delivery	216	*7.3*	234	*7.5*	299	*9.8*	343	*10.5*	<0.01
Fetal macrosomia	210	*6.9*	221	*6.9*	215	*6.8*	218	*6.6*	0.6
Postpartum haemorrhage	121	*4.0*	131	*4,2*	190	*6.2*	196	*6.1*	<0.01

*Difference between 2005 and 2008

Table 2 : Number and Rate (% of deliveries) of severe PPH*, 2005 to 2008, in the 2 units

	2005		2006		2007		2008		
Level II Unit	n	*%*	n	*%*	n	*%*	n	*%*	P**
All Severe PPH	32	*2.1*	9	*0.6*	8	*0.5*	11	*0.6*	<0.01
Severe PPH at vaginal delivery	21	*1.8*	6	*0.5*	3	*0.3*	8	*0.6*	<0.01
Severe PPH at caesarean delivery	11	*2.8*	3	*0.8*	5	*1.4*	3	*0.7*	<0.01
Level III Unit	n	*%*	n	*%*	n	*%*	n	*%*	P**
All Severe PPH	45	*1.5*	41	*1.6*	33	*1.1*	31	*1.0*	0.05
Severe pph at vaginal delivery	27	*1.2*	25	*1.0*	16	*0.7*	9	*0.4*	<0.01
Severe pph at caesarean delivery	18	*2.8*	16	*2.3*	17	*2.5*	22	*3.1*	0.8

*severe PPH defined as a PPH associated with one or more of the following: blood transfusion, arterial embolisation, arterial ligation, other conservative uterine surgery, hysterectomy, transfer to an intensive care unit, peripartum haemoglobin delta of 4 g/dl or higher, or maternal death

**Difference between 2005 and 2008

Table 3 : Characteristics of care provided for severe PPH, 2005 to 2008, in the 2 units

	2005		2006		2007		2008		
Level II Unit	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**P***
	32	*100*	9	*100*	8	*100*	11	*100*	
▪ Global quality of care									
Optimal care	15	*47*	8	*88*	5	63	8	73	0.1
Sub-optimal care	17	*53*	1	*22*	3	37	3	27	
Non-optimal care	0	*0*	0	*0*	0	*0*	0	*0*	
▪ Specific components of management									
All Severe PPH	32	*100*	9	*100*	8	*100*	11	*100*	
Administration of oxytocin	27	*84*	9	*100*	8	*100*	11	*100*	0.8
Call for additional staff	28	*88*	8	*89*	8	*100*	10	*91*	0.9
Severe PPH at vaginal delivery	21	*100*	6	*100*	3	*100*	8	*100*	
Pharmacological prophylaxis	10	*48*	5	*83*	2	*67*	7	*88*	0.1
Examination of the uterine cavity	15	*71*	6	*100*	2	*67*	6	*75*	0.8
within 15 minutes of PPH diagnosis	9	*43*	5	*83*	2	*67*	5	*63*	0.6
Instrumental examination of vagina/cervix	5	*24*	6	*100*	3	*100*	7	*88*	<0.01
Severe PPH due to uterine atony	21	*100*	7	*100*	7	*100*	6	*100*	
Intravenous administration of sulprostone	8	*38*	6	*86*	6	*86*	5	*83*	0.1
within 30 min of PPH diagnosis	6	*29*	6	*86*	5	*71*	5	*83*	0.05
Level III Unit	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**P***
	45	*100*	41	*100*	33	*100*	31	*100*	
▪ Global quality of care									
Optimal care	10	*22*	9	*22*	14	*42*	19	*61*	<0.01
Sub-optimal care	24	*53*	27	*66*	18	*55*	11	*35*	
Non-optimal care	11	*24*	5	*12*	1	*3*	1	*4*	
▪ Specific components of management									
All Severe PPH	45	*100*	41	*100*	33	*100*	31	*100*	
Administration of oxytocin	43	*96*	36	*88*	32	*97*	31	*100*	0.9
Call for additional staff	43	*96*	41	*100*	31	*94*	30	*97*	0.9
Severe PPH at vaginal delivery	27	*100*	25	*100*	16	*100*	9	*100*	
Pharmacological prophylaxis	5	*19*	18	*72*	10	*63*	9	*100*	<0.01
Examination of the uterine cavity	19	*70*	23	*92*	16	*100*	8	*89*	0.5
within 15 minutes of PPH diagnosis	7	*26*	22	*88*	10	*63*	8	*89*	<0.01
Instrumental examination of vagina/cervix	11	*41*	18	*72*	9	*56*	8	*89*	0.03
Severe PPH due to uterine atony	35	*100*	29	*100*	14	*100*	19	*100*	
Intravenous administration of sulprostone	20	*57*	25	*86*	13	*93*	18	*95*	<0.01
within 30 min of PPH diagnosis	5	*14*	16	*55*	7	*50*	18	*95*	<0.01

* Difference between 2005 and 2008